tion of the works of Foucault, and at the expense of the Imperial treasury. It was presented to the Academy of Sciences on December 13, 1869, then given by Napoleon III. to the Observatory, where it has been installed since 1872.

The instrument, as designed by Foucault, of which M. Wolf has published a complete and detailed account, rests on a brass stand supported by three screws, with two levels placed crossways, and a regulating azimuth movement. There are three distinct parts—the mirror and its mounting, the polar axis and the mechanism which connects this axis with the mirror, and lastly the regulator.

The plane mirror, 30 centimetres in diameter, was constructed by M. Ad. Martin, according to the method devised by Foucault; it is carried by a horizontal axis on the top of two vertical supports, which turn round a centre. This movement is perfectly effected by means of a circle of small wheels placed at the foot of the supports. The mirror is kept in its mounting by means of cleats and spiral springs, in order to avoid all irregularity of surface. In the centre of the mounting is fixed perpendicularly a directing handle, which slides through a ring carried by a fork jointed to the lower extremity of the horary axis. The direction of the incident ray being that of the axis of the fork, and the length of this fork being equal to the distance of its point of articulation from the horizontal axis of the mirror, the line which measures that distance gives the constant direction of the reflected ray.

Finally, a clockwork movement, the isochronous regulator of Foucault (Fig. 2), placed at the foot of the instrument, communicates to the mirror a motion sensibly equal to the diurnal motion, so that the celestial bodies maintain invariable positions in the field of a horizontal telescope, in front of the apparatus directed towards the mirror.

The entire apparatus, the principle of which is the same as that of the heliostat, rests on a triangular support; a hole on the north side receives the weight which drives the clock. A wooden cabin, moving on wheels from north to south, forms a shelter for the instrument. For the purpose of observation the siderostat is completely exposed by rolling the hut towards the north. The telescope, supported on two pillars, is placed in a brick hut, some little distance from the siderostat; this hut is very slightly elevated for the purpose of intercepting the least possible portion of the southern sky. A telescope with a mirror of silvered glass, pierced in the centre to receive the eye-glass, is the one at present employed.

If it is desired to bring into the telescope the light proceeding from a star whose polar distance and right ascension are known, this is done by two circles, which correspond, the one to the polar distance and the other to the horary angle for the moment of observation in the usual way. Then, the circles being fixed, the clockwork is put in motion and the mirror throws continuously into the telescope the rays proceeding from the star under observation. The clock movement, already applied to some great equatorials, is perfectly regular, and obtained for its clever maker, M. Eichens, the grand prize in the mechanical arts at the Universal Exhibition of 1867.

It was necessary to possess, for the siderostat, some means of adjustment so as to be able to vary in very small quantities the horary angle or the polar distance without stopping the movement. The former variation is obtained by means of a subsidiary wheelwork which has already been long in use. But the variation of the polar distance was more difficult to accomplish; M. Eichens, however, has solved the difficulty after a very ingenious fashion.

The siderostat, since its construction, has been almost exclusively employed for photographic experiments in connection with the approaching transit of Venus. Consequently we do not yet know what results we have a right to look for. But in the ideal of Foucault, the instrument ought to be an indispensable auxiliary of physical astronomy; this is its proper purpose. Experiments which demand perfect steadiness will be advantageously made, such as the measure of the positions of spectrum lines and of the displacement of these lines by means of fixed spectroscopes of large dimensions. It is easy to conceive, besides, the numerous advantages resulting from the fixed direction of reflected rays. We may henceforth adapt, with the greatest ease, to the observing telescope, the apparatus necessary for the work of celestial photography for photometric researches.

The complete instrument, telescope and siderostat, placed in the plane of the meridian, may be regarded as a meridian instrument; and the determination of the right ascensions and polar distances of known stars will enable us to rectify the adjustment already made of the relation between the telescope and the siderostat. The purpose is evidently thus not to obtain a transit instrument, but only to get an approximation equal to that of equatorial observations. It is, besides, always in our power to increase the precision by comparing the star under observation with a well-known neighbouring star.

Observations by means of the siderostat may be made in two ways—with the mirror fixed, or turning under the action of the clockwork. In the former case, the instrument becomes to some extent an equatorial, but with the advantage to the observer that he has not to change his position. An inconvenience appears here; each time that the mirror is moved the direction of the apparent movement changes, and consequently it becomes necessary to make a new adjustment of the micrometer threads.

This inconvenience is more serious if, when the mirror is in motion, it is desired to effect measurements of double stars. In this case the direction of the diurnal motion changes the angles of position. It is then necessary to measure the angles of position by starting with the vertical and the horizontal, and, by means of the hour of observation, reducing them to the ordinary form.

The real defect of the siderostat, which, however, it has in common with all other instruments of observation, is that it does not enable us to examine the entire heavens. But the most interesting region for research is comprised between the pole and the southern horizon, and the siderostat which we have described permits observations between these limits. Should it be desired to investigate the rest of the sky, a second siderostat would be necessary, reflecting the rays towards the north.

Let us not, in conclusion, forget that the reflection from the mirror of the instrument causes a slight loss of light; the proportion of light reflected is constant and equal to 93-100 of the incident light for new silver.

From this description it is clear that it is only from the standpoint of physical astronomy that the employment of the instrument will be most useful; and no doubt, in this direction, it will give numerous and important results. The problems of the universe offer, indeed, a productive and inexhaustible mine, and the new astronomy, with its powerful means of investigation, gives us reason to hope that future researches will bring to light some brilliant discoveries.

## NOTES

THE *Western Morning News* has received from its correspondent on board the *Challenger* an account of the voyage to New Zealand, which has been stormy and protracted. The result of the soundings has been most satisfactory, and it is confidently expected that New Zealand will be telegraphically connected with Europe next summer. The bottom was sand and mud, gradually shelving to a depth of 2,600 fathoms, at which it remained very evenly for a long distance, the temperature at this depth being 33 degrees and at the surface 64 degrees. At this point the soundings commenced getting less, and the next was found to be 1,975 fathoms (temperature 36 degrees). Two days after this 1,100 fathoms was recorded, the temperature rising to 36 degrees. These indications of shallow water were not without cause, for on the second day they came unexpectedly into 400, 350, and at last only 275 fathoms. This was about 200 miles from land. The future movements of the *Challenger* have now been arranged, and are thus stated :—At Wellington we remain till July 6, then proceed along the east coast, probably calling at Auckland for a few days, after which a course will be shaped to Tongataboo (Friendly Islands), and from thence to Kandsvan (Fiji Islands), where a supply of coal will be taken on board prior to leaving for New Guinea. Here a complete series of explorations and soundings will be made, and it is expected that the dredge and trawl will bring even greater wonders of marine life to the surface than have yet been secured, while the question of coral reefs and their history will have special attention. After cruising about Polynesia generally for some time, we expect to reach Hong Kong early in November, where probably a month will be spent in coaling, provisioning, refitting, &c.

THE last number of Petermann's *Mittheilungen* contains a summary of the recent work done by the *Challenger* Expedition, which is accompanied by an excellent and ingeniously constructed series of coloured diagrams, showing the distribution of temperature in the North and South Atlantic, as well as the configuration of the bottom over which the *Challenger* has sailed. The number also contains the continuation of Prof. Hans Höfer's paper on the structure of Novaya Zemlya.

THE growth of tea and sugar in European soil are perhaps branches of culture which we can scarcely expect to be remunerative in a commercial point of view. Be this as it may, the sugar-cane is now grown and sugar manufactured to some extent in the neighbourhood of Malaga, Spain. Tea has also been introduced into the southern districts of Sicily, and though the first attempt made last year to raise the plants on a large scale was not successful, owing, it is said, to the injury caused to the plants and seeds by immersion in sea-water on their transit from Japan, it is confidently hoped and believed by the promoters that another attempt with healthy seeds and plants will prove quite successful. Meanwhile tea is being grown at the Cinchona plantations in Jamaica, and a sample has recently been received at the Kew Museum which was grown and manufactured as above from Assam tea plants received through Kew in 1868. So far as the appearance of the sample is concerned, it is roughly manipulated, not being sufficiently twisted or curled, and apparently not sufficiently roasted. Nevertheless, its manufacture is little inferior to that of the earliest samples of Assam tea that appeared in the English market. Its quality, however, is another thing, for it produces a very watery infusion of a very herby flavour, and devoid of the aroma for which tea is noted. Care, however, in the cultivation of the plant, as well as in the selection and manipulation of the leaves, may in time produce a more marketable article.

THE Ochro (*Abelmoschus esculentus*), a Malvaceous plant, is well known in all tropical countries, being cultivated for the sake of its fruits, which are gathered in a green state, and either boiled and eaten as a vegetable, pickled in vinegar like capers, or used for thickening soups on account of the mucilage they contain—a common property of the Malvaceæ. In India the seeds are sometimes boiled for making a mucilaginous drink. But we now learn that a fine oil has recently been discovered in them of a quality equal to olive oil, and that it is intended to introduce this oil to commerce. Supposing the oil to be all that is said about it, the question arises as to the supply of seeds. Though the plant is easily cultivated, can it compete with other oleaginous plants?

WE some time since noticed the formation, in connection with the French Geographical Society, of a Commission of Commercial Geography. Under the patronage of this Commission a joint stock company has been formed for the publication of a weekly journal to assist in carrying out the objects aimed at by the Commission. The title of the journal will be *L'Explorateur, Journal Géographique et Commercial.*

EXPERIMENTAL verifications are becoming daily more numerous in favour of the view that the phenomena attending the electrical stimulation of the brain are, in reality, dependent on the indirect excitation of the cerebral basal ganglionic centres by the currents employed. Besides the observations of Dr. Sanderson on this point, already published in this journal (NATURE, vol. x. p. 245), Dr. J. J. Putnam has recorded the results attending electrical stimulation of the so-called surface-centres after their almost complete separation from the rest of the hemisphere in the form of flaps. He finds that under these circumstances no movements follow the excitation; but that if the flap is raised and the surface below it irritated, a current slightly more powerful than the minimal required in the uninjured condition produces exactly similar results. The details of these experiments, taken from the *Boston Medical and Surgical Journal*, will be found in the *London Medical Record* for last week.

THERE has been issued from the Standards Department, by Mr. H. W. Chisholm, an account of the comparisons at that department between two Russian pendulums and Repsold's scale of 21 old French inches, and between Repsold's scale and the standard subdivided imperial yard.

THE French Geological Society has decided upon holding its next meeting at Mons, in Belgium, a most interesting place for excursions. It is very seldom that French Scientific Societies meet in a foreign land.

ON Friday evening M. Flammarion, the French astronomer, started from La Villette gas-works, Paris, in a balloon called *Lumen*, at half-past seven, with a brisk breeze from the north-west. The balloon was under the guidance of M. Jules Godard, and M. Flammarion, who was married in the beginning of August, was on board with his young wife; he wishes to spend his *lune de miel* in Italy. Such a trip was proposed in the beginning of the century to the celebrated Mdme. de Stael by the great philosopher, Saint-Simon; but the lady declined. The moon was full and bright.

THE use of carrier pigeons for press purposes is on the increase, and the breed is rapidly improving. By careful "selection" and allowing only the "survival of the fittest," powers have been developed which a few years ago would have been thought impossible. They can be specially trained to fly over 500 miles, and it is no uncommon thing for despatches to be brought to London from Paris, Lisbon, or Brussels. *Land and Water* records a case of interest. An ocean homing bird, of great docility, intelligence, and spirit, has been found in Iceland which flies at the meteor-like speed of 150 miles an hour. A pair of these birds whose present home is in Kent, within ten miles of London, recently carried despatches from Paris to their home in one hour and a quarter. Press pigeons carried on the despatches to London, and the whole journey of the despatches from Paris to London occupied only one hour and a half. The press pigeons now commonly used are not the ordinary carrier pigeons, but are bred by Messrs. Hartley, of Woolwich, from prize birds selected from the best lofts of Antwerp, Brussels, and Liege.

AN alarming shock of earthquake was felt in the island of Porto Rico on the morning of Aug. 26, at 6.15 A.M. The vibration lasted two minutes. No report of the extent of damage done has yet been received.

An eruption broke out in Mount Etna on Sunday evening last. The lava issued from the crater by three mouths, all of which, however, are happily some distance from human habitations.

The *Times of India* states that the report which M. Victor de Lesseps and Mr. C. Stuart will have to make on their return to Europe on the feasibility of the great Central Asian Railway scheme will be of a character to render it likely that preliminary funds will be subscribed to enable the first surveys to be effected with a view to definitely settle the route which it would be desirable to follow.

We have received from Mr. Stanford the Alpine Club Map of Switzerland, edited by Mr. R. C. Nichols, the preparation of which we noticed in vol. vi. p. 205. It is a very fine specimen of map making, and a credit to English cartography. We hope soon to notice it in detail.

If the observations recorded by Mr. F. M. Balfour at the recent meeting of the British Association, on the development of the notocord from the hypoblastic, instead of the mesoblastic layer of the embryo in the shark, are confirmed, they will shake to the foundation the importance of the elaborate arguments which have been, of late, so frequently based upon the origin of the different morphological elements of the living frame.

We are sure many of the recent visitors to Belfast must have found an invaluable aid in their wanderings about the town and district, which so abounds in varied interest, in the very excellent "Guide to Belfast and the Adjacent Counties" (Belfast, Ward and Co.), which has been brought out under the care of the members of the Belfast Naturalists' Field Club. Great prominence is of course given to the scientific aspects of the districts embraced in the Guide, but a fair portion is also devoted to the ordinary objects of interest, to trade, commerce, manufactures, &c. The Guide is well arranged under the various headings of Physical Geography, Geology, Botany, Zoology, Topography, &c., and is amply illustrated with forty-six roughly executed but very useful plates, mostly of objects of antiquarian interest. We heartily recommend the book to any visitor who wants an intelligent guide to the counties of Down and Antrim, a good map of which is appended.

The additions to the Zoological Society's Gardens during the past week include a Cassowary (*Casuarius?*) from N.E. New Guinea, presented by Capt. Maisby; a Javan Chevrotain (*Tragulus javanicus*) from Java, presented by Mr. G. Mannings; a Formosan Deer (*Cervus pseudaxis*) from the Island of Formosa, presented by Mr. Abel A. J. Gower; two Black Swans (*Cygnus atratus*) from Australia, presented by Mr. R. H. Bower; an Indian Python (*Python molurus*); a Vervet Monkey (*Cercopithecus lalandii*) from South Africa, presented by Mr. C. Hassam; two Black-eared Marmosets (*Hapale penicillata*) from Brazil, presented by Mr. J. P. Harrison.

## *THE BRITISH ASSOCIATION*

The Belfast Session of the British Association was brought to a conclusion on Wednesday, the 26th ult., with mutual congratulations between all concerned. In our animadversions on the high charges for sleeping accommodation charged from some of the members of the Association, we of course meant in no way to reflect on the local authorities or local committee, who exerted themselves to the utmost to render the meeting in every way a success. The vote of thanks to the Mayor was thoroughly deserved, as was also the tribute of praise awarded by the Rev. Dr. Henry to the "unflagging zeal" of Dr. Andrews in behalf of this meeting of the Association. One very pleasing result of the meeting, and of a discussion in the Economical Section, was the sudden termination of the extensive strike which had existed in Belfast for a considerable time. The various excursions organised on Thursday were a decided success.

The next meeting opens at Belfast on August 25, 1875.

The Committee, among other things, have recommended, and their recommendation has been adopted, that the Council of the Association be requested to take such steps as they may think expedient to urge upon the Government of India the desirableness of continuing solar observations; that the Council of the Association be requested to take such steps as they may think desirable with the view of appointing naturalists to vessels engaged on coasts of little-known parts of the world; that they be requested to take such steps as they may think desirable to promote any application that may be made to her Majesty's Government by the Royal Society to promote physiological and biological explorations in the seas round the British Isles; that they be requested to take such steps as they think desirable for supporting a request to her Majesty's Government to undertake an Arctic expedition on the basis proposed by the Council of the Royal Geographical Society at the beginning of the present year, and which will be made again by that body.

The following is a synopsis of grants of money appropriated to scientific purposes by the General Committee at the Belfast Meeting:—

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| MATHEMATICS AND PHYSICS. | |
| *Cayley, Prof.—Printing Mathematical Tables | £100 |
| *Balfour Stewart, Prof.—Magnetisation of Iron | 20 |
| *Brooke, Mr.—British Rainfall | 120 |
| *Glaisher, Mr. J.—Luminous Meteors | 30 |
| Maxwell, Prof. C.—Testing the Exactness of Ohm's Law | 50 |
| Stokes, Prof.—Reflective Power of Silver and other Substances | 20 |
| *Herschel, Prof.—Thermal Conducting Powers of Rocks | 10 |
| *Tait, Prof.—Thermo-Electricity (renewed) | 50 |
| CHEMISTRY. | |
| *Williamson, Prof. A. W.—Records of the Progress of Chemistry | 100 |
| Roscoe, Prof.—Specific Volumes of Liquids | 25 |
| Allen, Mr.—Estimation of Potash and Phosphoric Acid | 10 |
| *Armstrong, Dr.—Isomeric Cresols and their Derivatives (renewed) | 20 |
| GEOLOGY. | |
| *Willett, Mr. H.—The Sub-Wealden Exploration | 100 |
| *Lyell, Sir C., Bart.—Kent's Cavern Exploration | 100 |
| *Lubbock, Sir J.—Exploration of Victoria Cave, Settle | 50 |
| *Bryce, Dr.—Earthquakes in Scotland (renewed) | 20 |
| Hull, Prof.—Underground Waters in New Red Sandstone and Permian | 10 |
| BIOLOGY. | |
| Dresser, Mr.—Report on Ornithology | 10 |
| Rolleston, Prof.—Development of Myxinoid Fishes | 20 |
| *Stainton, Mr.—Record of the Progress of Zoology | 100 |
| *Fox, Col. Lane.—Forms of Instruction for Travellers | 20 |
| *Brunton, Dr.—The Nature of Intestinal Secretion | 20 |
| GEOGRAPHY. | |
| Wilson, Major.—Palestine Exploration Fund | 100 |
| STATISTICS AND ECONOMIC SCIENCE. | |
| *Houghton, Lord.—Economic Effects of Trades' Unions | 25 |
| MECHANICS. | |
| Froude, Mr.—Instruments for Measuring the Speed of Ships (renewed) | 50 |
| Total | £1,180 |

* Reappointed.